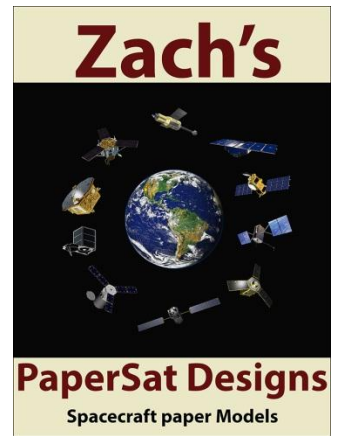


TRS Mk1 Picosatellite

$\frac{1}{2}$ Scale Paper Model Instructions



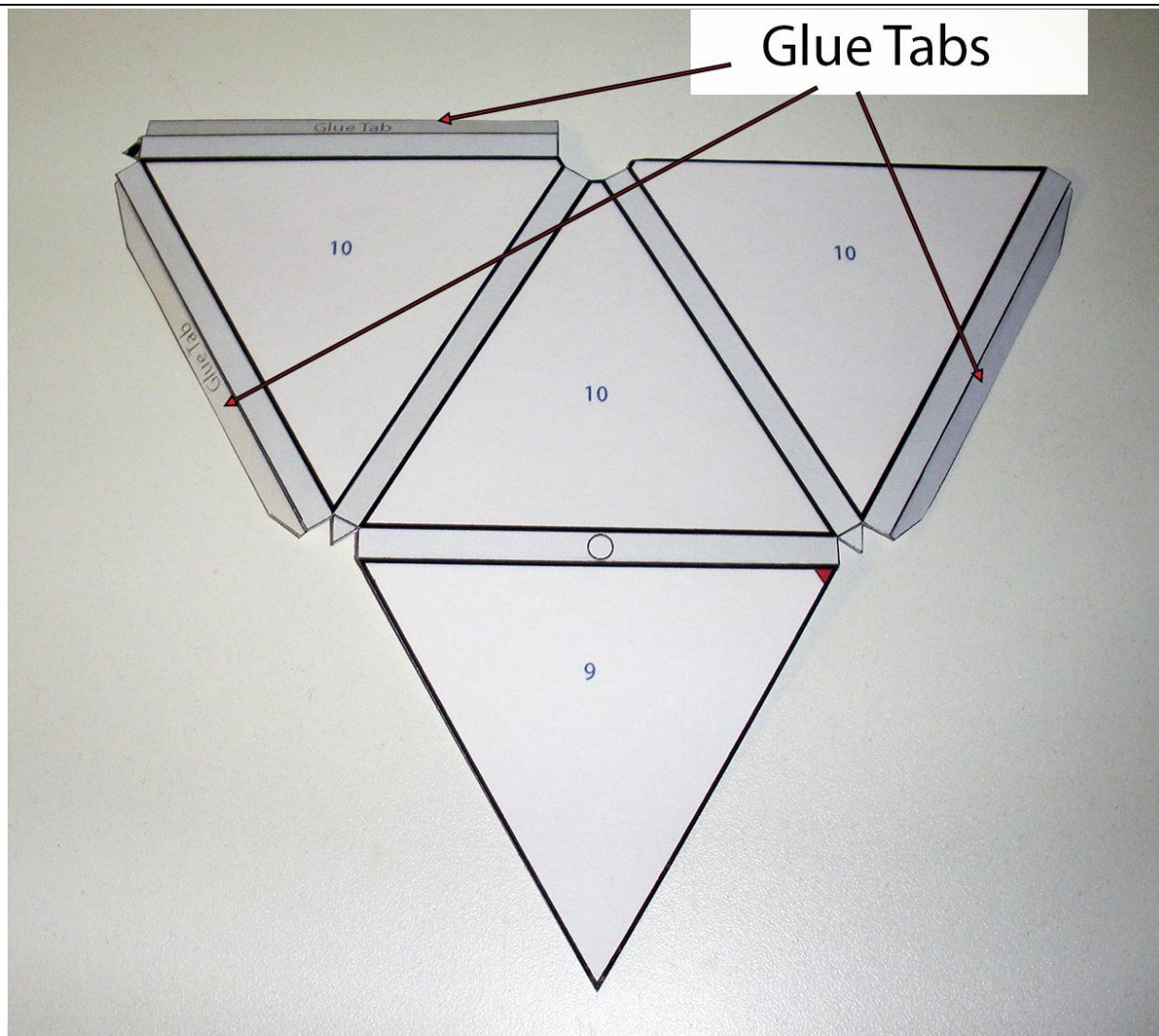
History

While most might believe that the concept of the picosatellite is a relatively new product of today's technology, it actually got its start over half a century ago as part of a USAF satellite series known as the Tetrahedral Research Satellite or simply TRS. These spacecraft were the world's first picosatellites be the forerunners of the much more capable picosatellites of today.

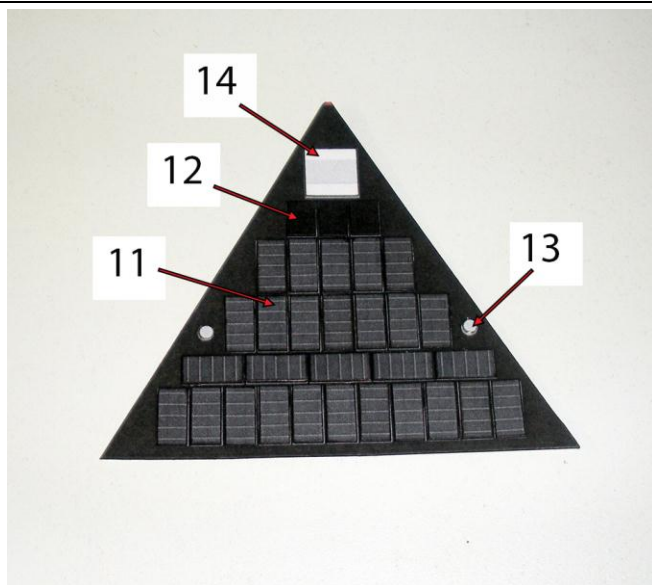
The TRS satellite was developed by a subsidiary of TRW called the Space Technology Laboratories (STL) in Redondo Beach, CA as an inexpensive, miniaturized satellite that customers could purchase off-the-shelf to perform simple experiments in orbit. The original TRS was a regular tetrahedron (i.e. a pyramid with four equilateral triangular-shaped faces) 16.5 centimeters across on each edge with a pair of deployable, meter-long antennas providing communications with the ground. Since the TRS had no attitude control system, each face of TRS was covered with 28 solar cells that could provide a nearly constant 600 milliwatts of power regardless of the satellite's orientation with respect to the Sun.

A solid-state analog telemetry system (in this era before integrated circuits, that would mean a "transistor-based" system) provided eight channels of data: five for experiments, one for the spacecraft temperature and a pair for telemetry calibration. In order to minimize the risk of TRS interfering with the communications of other satellites after it had completed its mission, TRS had a built-in timer that would deactivate the transmitter after approximately 90 days in orbit. With a mass of only 667 grams, TRS would be the smallest working satellite ever placed into orbit. For comparison, the Naval Research Laboratory's solar-powered Vanguard 1 launched in March 1958 (which was the world's first nanosatellite and the smallest launched before TRS) was a sphere 16.5 centimeters across with a mass of 1.47 kilograms (see "Vintage Micro: The Original Nanosatellite"). Excluding the costs for development, launch and mission operations, each TRS satellite was estimated to cost only \$25,000 to build (that would be about \$195,000 in today's money). STL's first (and, as it would turn out, only) customer for TRS was the Air Force Space Systems Division (AFSSD) then headed by Col. T. O. Wear. AFSSD bought the first six TRS satellites to be used in their Environmental Research Satellite (ERS) program. These first satellites, which would be launched into orbit as piggyback payloads on larger Agena-based USAF satellites, would be used to assess the effects of radiation on the performance of solar cells and, by using specially calibrated cells, measure the radiation exposure of the satellite. Aside from modifications that were needed to make the satellite's telemetry system compatible with NASA and USAF ground tracking stations as well as the addition of five calibrated solar cells, the satellites were essentially ready to fly. Additional satellites were constructed to meet AFSSD needs and in the end, a total of ten original TRS satellites were constructed and launched.

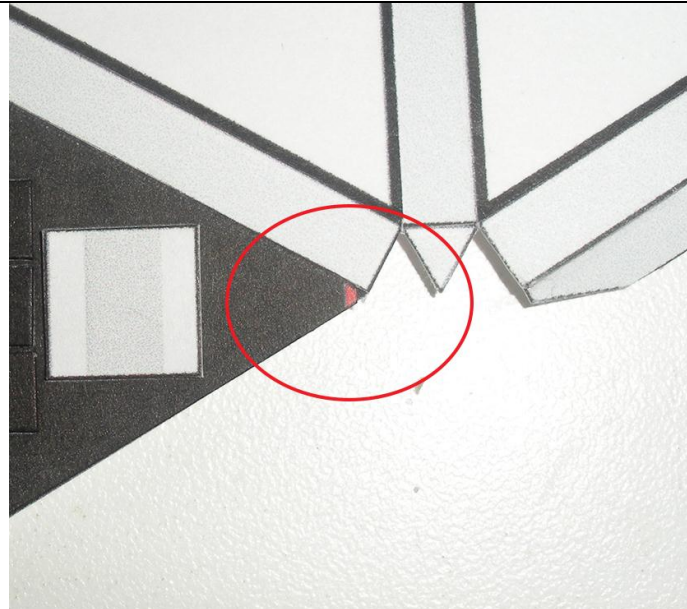
The first TRS launch attempt used the satellite designated ERS-2. It was sent into orbit on September 17, 1962 riding as a piggyback payload on the KH-4 Number 12 of the Corona spy satellite series (codenamed "Big Flight") launched on a Thor-Agena B from Vandenberg AFB in California. Called TRS 1, it failed to separate from the Agena B once in its 307-by-584 kilometer orbit inclined 81.8° to the equator. But according to reports at the time, TRS 1 managed to return up to 8 minutes of usable data during each favorable pass allowing measurements of the radiation that had been generated from a high altitude nuclear detonation over Johnston Island on July 9, 1962 codenamed "Starfish". The KH-4 reentry vehicle and its payload of exposed film were returned to Earth on September 18 while TRS 1, still attached to the equipment rack on Agena 1133, continued on until its orbit decayed on November 19.



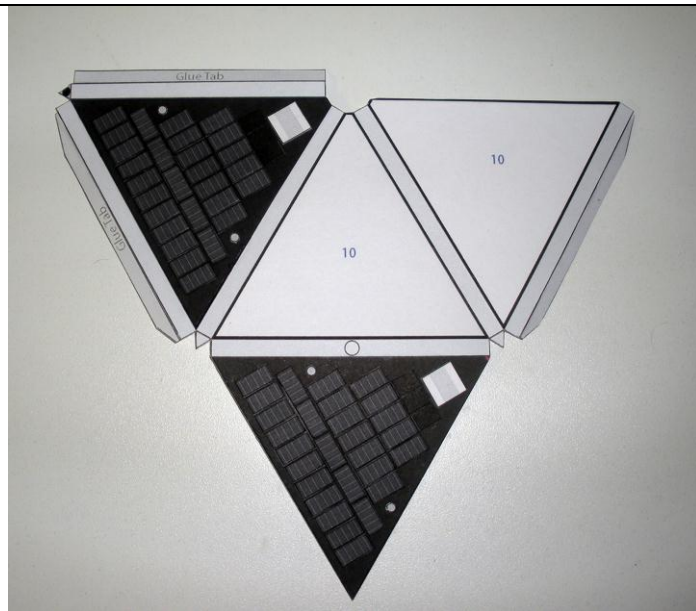
Glue the glue tabs in place as shown. Score OUTSIDE edge of the black triangle lines for folding. Don't fold into a pyramid yet.



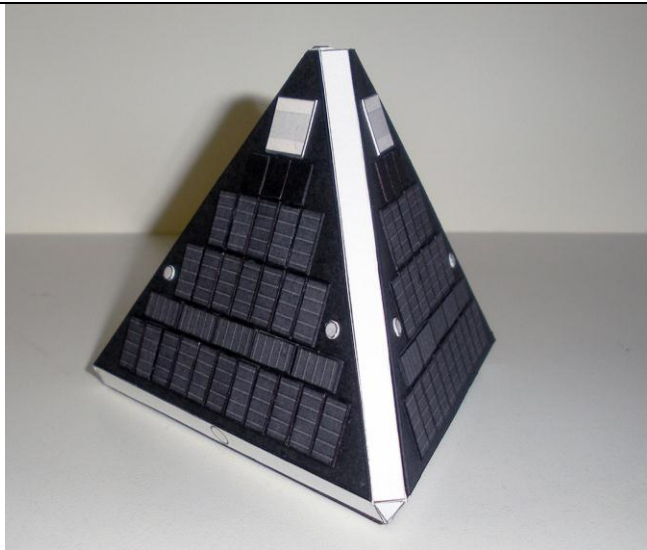
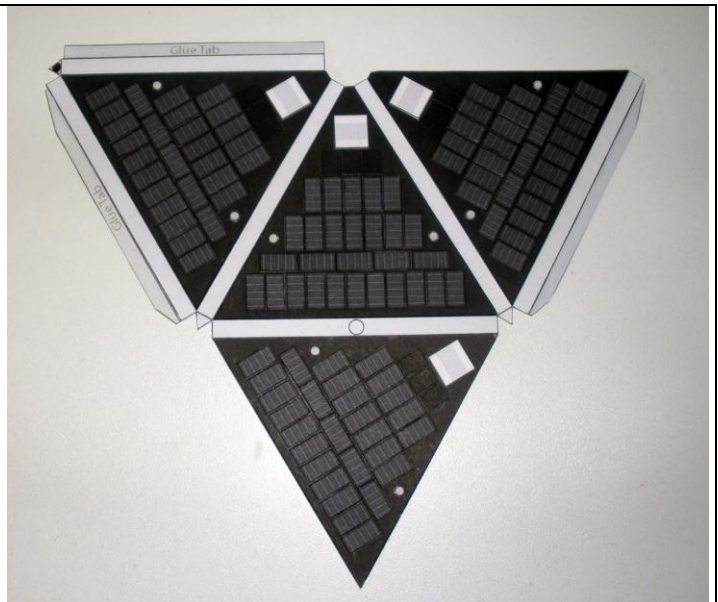
Glue these parts onto all four side parts (9 and 10) as shown



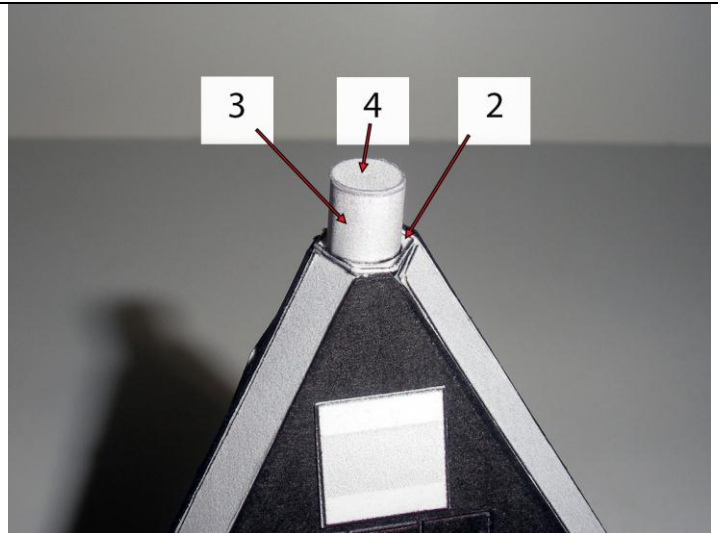
Glue Part 9 in the area labeled '9', Match the two red markers.



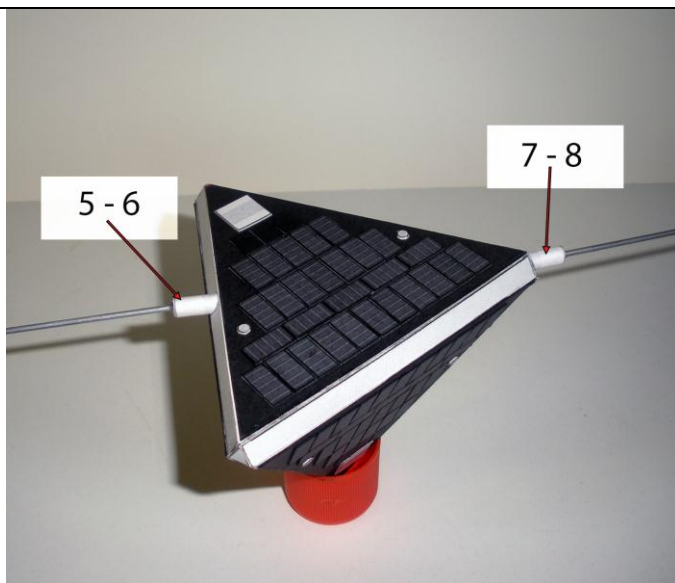
Glue the remaining sides (Part 10) in place as shown.



Fold and glue into a pyramid



May need to rotate this assembly for best fit.

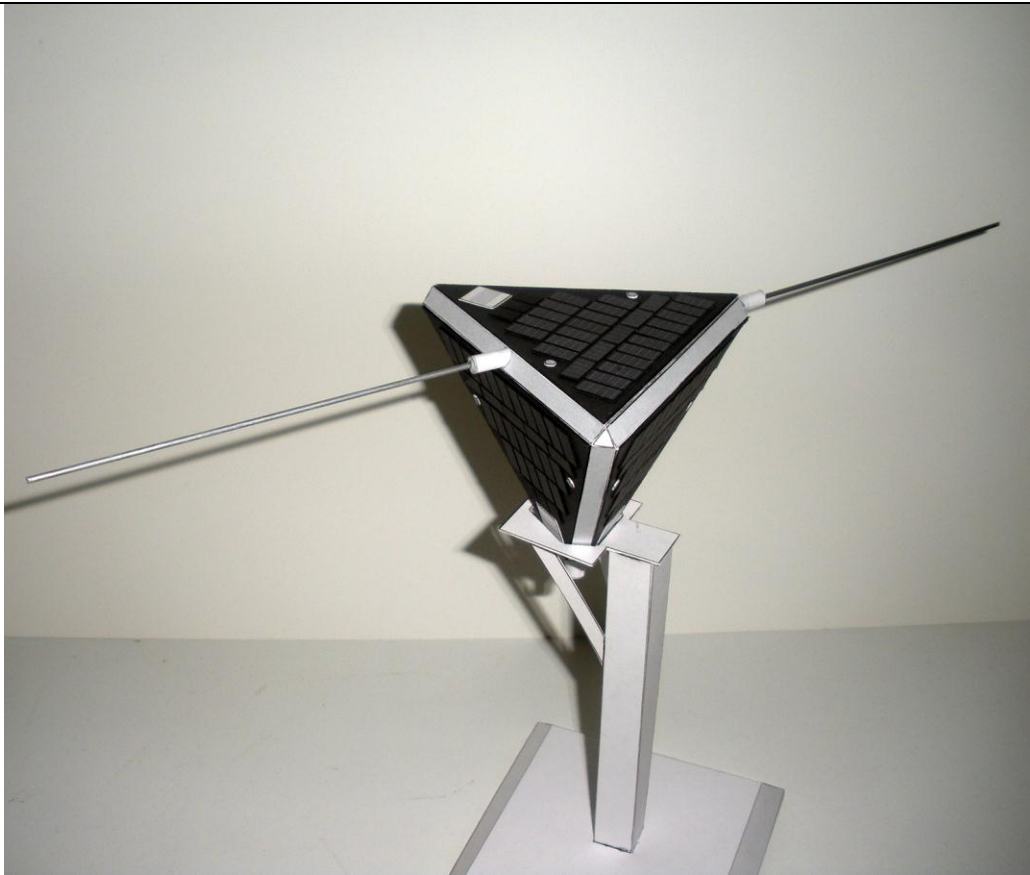


Poke small holes on parts 6 and 8 before assembly. Glue these as shown. Parts 7-8 are glued on the corner with the black circle.

Antennas.

1/16 or 1.6mm diameter Acrylic rods cut at 4 ½ inches long, colored grey was used.

If you want the antennas to be in scale with the model, each one would need to be around 1 ½ feet long.



Completed model. This is the position the spacecraft in orbit.

